Chapter 12
Building a Holistic Picture: An Integrative Analysis of Current and Future Prospects for Non-timber Forest Products in a Changing World

Charlie Shackleton, Sheona Shackleton, and Patricia Shanley

Abstract This final chapter seeks to synthesise key discussions and conclusions from the preceding chapters. Each chapter deals with a specific dimension of NTFP use and management, but when read together, offers a revealing overview of the discourses, debates, and dilemmas associated with the use and promotion of NTFPs over the past two to three decades. Here, we capture this bigger picture through the development of an integrated understanding of these issues and debates. While unpacking broadly applicable lessons and generalisations, we also attempt, given the varied profiles and contexts of NTFPs, to go further through questioning how an integrated understanding stands up to scrutiny as local and global circumstances change. This is particularly pertinent as the key foundations underlying the policy and functional value of NTFPs change. Lastly, we consider some of what we perceive to be the key areas that need investigation or resolution over the coming decade.

12.1 Introduction

The preceding chapters have together presented a comprehensive appraisal of the role and importance of non-timber forest products (NTFPs) in livelihoods, economies, and biodiversity conservation throughout the world. Although the emphasis has been on rural situations and the developing world, evidence is also provided of the contribution of NTFPs in urban settings and in developed countries. Each chapter deals with a specific dimension of NTFP use and management, but when read together they offer a revealing overview of the discourses, debates, and

C. Shackleton and S. Shackleton (✉)
Department of Environmental Science, Rhodes University, Grahamstown 6140, South Africa
e-mail: c.shackleton@ru.ac.za, s.shackleton@ru.ac.za

P. Shanley
Center for International Forestry Research and Woods and Wayside International, 211 Ridgeview Road, Princeton, NJ 08540, USA
e-mail: p.shanley@cgiar.org

S. Shackleton et al. (eds.), *Non-Timber Forest Products in the Global Context*, Tropical Forestry 7, DOI 10.1007/978-3-642-17983-9_12,

dilemmas associated with the use and promotion of NTFPs over the past two to three decades. With contributions from ecologists, economists, anthropologists, botanists, geographers, conservationists, and policy analysts, this final chapter offers an interdisciplinary synthesis that will be useful for experienced actors operating in the field of NTFPs, as well as newcomers seeking insights into the complexities and subtleties of the debates, approaches, and policy options.

While each chapter presents its own conclusions, it is the integration across the chapters that facilitates the development of a deeper understanding. Promoting an integrated understanding of issues surrounding NTFPs is the primary purpose of this concluding chapter. This is difficult, however, as a vast array of plants and animals are lumped under the NTFP umbrella. The sheer magnitude of species, their extensive geographic ranges, divergent socioeconomic contexts, and the idiosyncratic nature of the many species termed an NTFP make it challenging to develop valid generalisations (Pierce 2002). Given such varied profiles and contexts of NTFPs, we attempt to go further through questioning how an integrated understanding stands up to scrutiny as local and global circumstances change. This is particularly pertinent as the key foundations underlying the policy and functional value of NTFPs change with growing urbanisation, globalisation, and environmental change. Lastly, we consider some of what we perceive to be the key issues that need investigation or resolution over the coming decade.

12.2 Building a Holistic Picture

12.2.1 NTFPs in Livelihoods

As a starting point it is instructive to revisit the underlying value of NTFPs. Throughout human history, people have devised ingenious ways of living with the natural resources available to them; serving cultures from widely diverse climates, landscapes, and vegetative zones (Chap. 2). Demands for exotic NTFPs and the subsequent spice trade were responsible for some of the earliest and most distant trade networks circumnavigating the earth. Harrowing voyages and intense conflicts took place to gain possession of spices such as nutmeg which, at the time, was worth its weight in gold.

Today, NTFPs continue to be used on an enormous scale for subsistence and food security, with much of this use remaining unchanged over generations and occurring without any form of external intervention; it is simply part of the way people live (Fig. 12.1). In addition, NTFPs remain a major component of local, regional, and global trade networks (Table 3.6, Chaps. 3 and 4), sustaining millions of families and linking urban and rural areas across the world (Chap. 6). While many markets evolved endogenously, more recently governments and development agencies have sought to promote the NTFP trade (Sect. 12.3), particularly at a global level, as a means to address poverty and to incentivise natural resource management and conservation.

Fig. 12.1 An everyday NTFP (winnowing basket) from the community-run Bigodi Wetland Sanctuary, Uganda. This community-based initiative combines conservation and tourism, particularly bird watching, with the sustainable use of wild resources (photo: Claire Shackleton)

The research reported in this book has shown that, despite a wide range of methodological approaches and divergent perspectives within the growing volume of work on NTFP valuation, NTFPs constitute an extremely important component of local livelihoods (Chap. 3). Contributions span the spheres of direct provisioning, income generation, cultural and spiritual needs, and safety nets in adverse times. It was recognition of this that first raised the expectation that it might be possible to "lift" poor people out of poverty through NTFP promotion and commercialisation (signifying accumulation of sufficient capital to move out of the World Bank's economic definition of poverty) (Chap. 3). There are now sufficient studies to show that the use and marketing of NTFPs can assist some households move out of poverty, but that they play their most significant role in preventing a deepening of poverty for many, many more (Chap. 3). The fact that NTFPs offer a locally accessible, free resource which serves to reduce vulnerability of some of the world's most marginalised populations is one which needs greater appreciation, especially in the context of global environmental change and the complex linkages between ecosystem health and human well-being (MA 2005).

It is also important to recognise that NTFPs not only have economic value but are often the backbone of cultural traditions among communities worldwide. Customs, beliefs, rituals, and traditions in areas as diverse as art, medicine, food, hunting, religion, and marriage often include or revolve around a selection of specific forest resources (Chap. 5). This aspect of NTFPs is critical for maintaining social capital and conserving culture and tradition, and may provide as important an incentive for natural resources management and conservation as monetary benefits. Certainly, the cultural role of NTFPs is one that is often neglected. Reductionist models and a primarily economic lens can blind researchers and policy makers to the substantial, but mainly unquantifiable, direct use and cultural value of forest products.

12.2.2 NTFPs in Conservation and Development

At the turn of the new millennium it was widely recognised that poverty throughout the world was rife and would require concerted and coordinated global efforts to make any positive impacts (WRI 2005). A similar outlook applied to what has been described as the biodiversity crisis (Laurance 2007). Previously the domain of researchers and activists on the margins, environmental issues began to gain credence in national politics and agendas throughout the world. Highest among these were climate change and biodiversity loss. However, it was widely perceived that the global poverty and biodiversity crisis were incompatible; development and poverty alleviation could only be achieved at the expense of biodiversity, and protection of biodiversity and conservation at the expense of improved human well-being and development. Given that levels of poverty and biodiversity are highest in the developing world, and in rural areas, this dilemma was most acute in these regions. Due to the shorter time scale to incur benefits, policy decisions frequently favoured development and economic exploitation over biodiversity (Edwards and Abivardi 1998).

During the late 1980s and 1990s, NTFPs were touted as one means of possibly reconciling this dilemma (Plotkin and Famolare 1992), namely a route to promoting and improving local livelihoods with only limited land transformation and biodiversity loss. At that time, the potential of NTFPs was still inadequately documented and poorly understood, but, in theory, the fundamental basis of the argument was sound and became attractive to a range of lobbies, particularly NGOs promoting local economic development and those linked to agencies concerned with biodiversity conservation (e.g., WWF, IUCN). They embraced the argument and hoped to accumulate sufficient evidence of its veracity and practicality to encourage industries to trade with rural communities engaged with NTFP production. Over time, in some countries, the arguments were also taken to the governmental level with the intent of amending and improving local and national policies which impact NTFP collectors on a wide scale. Consequently, there was a burgeoning of development initiatives in this area accompanied by diverse research that aimed to inform practice (Box 12.1). The results and findings from this work are mixed and are discussed in more detail in the next section.

12.2.3 Sustainability

Having established that NTFPs contribute meaningfully to the livelihoods of many, indeed most, rural people in developing countries (Sect. 12.2; Chaps. 3–6), it is necessary to ascertain whether this is at expense of biodiversity and the future of the particular species used. The fundamental question is – can livelihood improvement go hand in hand with improved natural resource management and biodiversity conservation?

Box 12.1 The Growth in NTFP Studies Over the Last Two Decades

Charlie Shackleton and *Dylan McGarry*, Department of Environmental Science, Rhodes University, Grahamstown, South Africa, c.shackleton@ru.ac.za; armadylan@gmail.com

Although NTFPs have been part of the daily lives of rural people for millennia, they remained effectively hidden to the eyes of forest researchers and managers until the late twentieth century. A few academic papers toward the end of the 1980s served to ignite a small, but latterly accelerating interest in every facet of NTFPs in terms of management, ecology, economics, governance, and contribution to local livelihoods.

We sought to display this growing interest and consequently undertook a small numerical literature search. We used the global Science Direct and Scopus search engines, using the terms "non-timber forest product", "minor forest product", and "nonwood forest product". The period of the search was from 1990 until the end of 2009. However, the returns for 2009 were lower than 2008, which we suspect was a consequence of not all 2009 papers being abstracted in those databases by the time of our search in March 2010. We excluded papers that dealt with laboratory testing of the properties of NTFPs, and those dealing with joint forest management or community-based natural resources management generally. A total of 398 papers were returned. Interestingly, although the field of NTFP research is over two decades old, almost half were published only in the last 4 years. There has been a steady increase in the output over the 20-year period covered (Fig. 12.2 and Fig. 12.3).

Examining the data by region of study shows that Asia dominates as a reporting area for NTFP studies. India had the most papers. South America (mainly Brazil, Peru, and Colombia) and North America (Canada, Mexico, and USA) followed. Undoubtedly there is a great deal more material from South America, but is not abstracted in English language databases. North Africa and the Middle East were the most poorly represented.

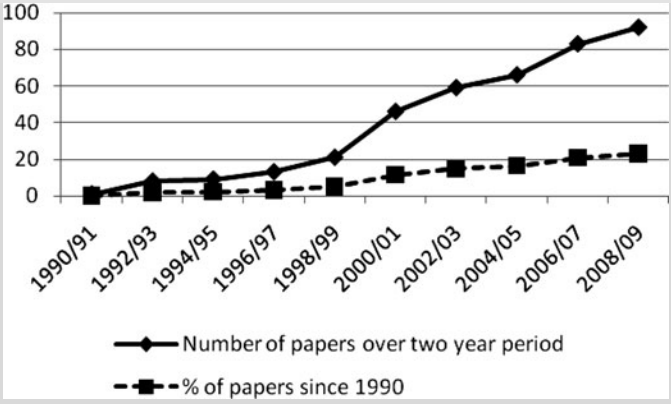

Fig. 12.2 Number of papers on NTFPs published in two-yearly intervals since 1990

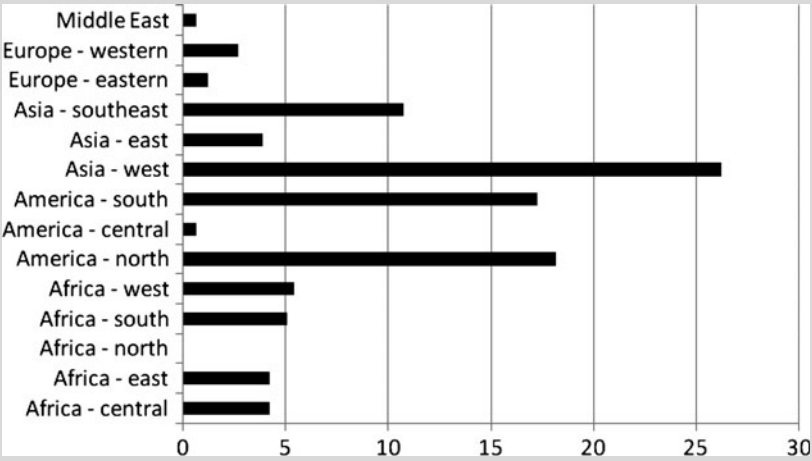

Fig. 12.3 The proportion of NTFP papers published between 1990 and 2009 by region, as abstracted in Science Direct and Scopus databases

When contemplating the sustainability of NTFP harvest, first it is important to recall that the majority of NTFP harvesting is invisible, undocumented, and used to meet subsistence and local needs. It is also worth noting that the scale of harvesting for local and household needs is frequently nondestructive. In terms of commercially harvested NTFPs the situation is highly context-dependent. Unfortunately, in contrast to the wealth of studies in NTFP value chains and value to livelihoods, there is far less work on quantifying the impacts of use on biodiversity (of the species harvested as well as the broader system) and determination of sustainable harvesting levels (Chap. 7).

As reflected above and in Chap. 1, and commented on further by Guariguata et al. (Chap. 8), there are literally tens, if not hundreds, of thousands of NTFP species. The basic biology of most of these has not been studied. The very detailed work in determining ecologically sustainable levels of harvest requires time; estimates spanning 1 or 2 years (perhaps three for the average PhD study) are insufficient (Chap. 8). Some impacts, such as nutrient declines or changes in competitive interactions between species, will only manifest over substantially longer time periods (Chap. 10). Even when the information is procured for a specific species, it cannot be unquestioningly extrapolated throughout the range of that species due to differences in biophysical conditions which may change various factors such as its growth rate, response to harvesting, and exposure to exacerbating pressures (such as browsing, fire, diseases, or predators). Secondly, the information dates rapidly. As human population pressures grow or livelihood options change, what may have been an ecologically sustainable harvesting system may become unsustainable. Thirdly, biological systems are complex and prone to unpredictable changes. Thus, there may be changes in the broader system other than human

population pressures which affect the potential for sustainable harvests from one year to the next (e.g., drought, floods, disease), and slowly through time (e.g., salinisation of soils, climate change).

Thus, ascertaining the ecological sustainability of NTFP use is not just a case of balancing supply and demand because both of these are highly variable, and so assessments must be context-specific in time and place. There is a dire need for a great deal more effort in understanding and developing models around harvesting impacts and ecologically sustainable off-take levels. However, given the substantial commitment of time and funds required to effectively research NTFPs and the tens of thousands of species lacking study, it would be necessary to prioritise research to focus on species under threat (long-lived, slow growing, rare), those identified by rural and urban users to be of critical local and regional use, and those involved in large-scale commercial trade which are nondomesticated. Conservation managers, policy makers, and researchers need to be able to place species along a gradient of urgency of research need. Scant governmental resources should be committed for species under threat or of particular health, nutritional, or cultural interest.

Drawing on what limited evidence there is, although very few with strong, long-term data sets, the results of sustainability studies parallel those from the livelihood and market chain studies, i.e., there is high variability. Some NTFP systems are ecologically unsustainable, caused by harvesting systems that have negative impacts on the target species and even the wider ecological system. Sunderland et al. (Chap. 10) argue that this is the most common scenario. This is the case for species that are filling a spike in commercial demand, or for those which are harvested where institutions and social and cultural norms have weakened. But along the spectrum of management there are innumerable harvest systems that, although often based on incomplete datasets, demonstrate ecological sustainability. Indeed, the principal use of NTFPs – at the local level for subsistence use – often exhibits sustainability given their relatively small-scale demand at community level. All biological resources have some theoretical level of ecologically sustainable harvest. The management and harvesting challenge is often whether or not governance systems recognise and respect these (Chap. 9) and the opportunity costs of doing so.

Making use of the quadrant depiction of Shaanker et al. (2004) for the analysis of winners and losers between livelihoods and biodiversity, it is possible to explore why in some situations harvesting is sustainable and in others not (Fig. 12.4).

		Livelihoods	
		Win	Lose
Biodiversity	Win	Achievement of positive livelihood and conservation/ sustainable natural resource management outcomes.	Protected areas that exclude harvesting.
	Lose	Positive outcomes for livelihoods, but high resource impacts.	Overexploitation and long term degradation. Loss of livelihood opportunity.

Fig. 12.4 Assessing the winners and losers in NTFP harvest systems

If particular products lie in the win–lose quadrant, it is necessary to question why and what might be required to shift these into win–win situations, as well as prevent current win–lose situations from degrading into lose–lose ones. It is here that current NTFP research is grappling.

The array of factors that potentially influence whether or not an NTFP is harvested sustainability and so continues contributing to livelihoods is vast. Most studies examine one or two factors in isolation. A few take on the herculean task of examining several, but these are still a subset of the broader array. But most point to aspects of governance systems as being crucial in shaping a particular situation or product falls, and into which other quadrant it may move in time.

For instance, it is strongly argued in diverse literature on forest management that without secure resource/land tenure rights for forest users, the goal of sustainable forest management will likely remain unattainable in the majority of situations. Yet despite recognition of this as a primary factor in good governance, it tends to be the one that is most often lacking (RRI and ITTO 2009, Chap. 9). Lack of property rights for forest resources undermines the governance and sustainable management of NTFPs, acting as a disincentive for long-term investment and protection and, at the same time, rendering poor forest-dependent people more vulnerable (Chap. 9). Secure property rights are therefore fundamental in shifting to the win–win block in Fig. 12.4. Data collected by RRI and ITTO (2009) have shown that increasing areas of forest around the world are coming under the ownership of local communities, and that this is likely to bode well for the future of these forests and the NTFPs they contain.

However, providing secure tenure, while an underlying necessity, will not on its own guarantee good governance or sustainable resource management. The situation is considerably more complex than that and many other factors may play a part. For example, other factors mentioned in Chap. 9 that are critical for pro-poor forest and NTFP governance include: local decision making and participatory processes, the rule of law which if not enforced can result in overregulation of poor peoples' access while powerful forest users (often harvesting valuable resources such as timber) face few restrictions, enabling market opportunities for poor resource users that provide incentives for good management, and effective alliances and partnerships between local people and other government and private actors. Furthermore, recognition of customary law and building on it for effective governance can assist in ensuring sustainability (Chap. 10). In many countries, customary and statutory laws play complementary roles, but it is common for new statutory laws to weaken effective customary systems. This may cause confusion and contribute to the erosion of governance and management systems (Chap. 10). Of course, for all of the above to happen there must be enabling policies in place that support devolution and decentralisation, communal tenure rights, the rights of indigenous people, local decision-making processes, capacity building, etc. This issue is provided substantive coverage in Chap. 10.

Another possible solution to the lose–lose scenario that has been mooted is the domestication and cultivation of NTFPs, often in an agroforestry context (Leakey et al. 2004; Michon 2005). This involves a move from wild harvesting to

deliberate cultivation (which may mean different actors), something not discussed specifically in this book. Like everything else we have considered regarding NTFPs, domestication is also a complex process involving both biological and social elements. Similar to any intervention, it has been successful for some species and in some contexts, but not in others. There are cases where previously wild harvested products have been domesticated to the extent they would be better classified as agricultural crops than NTFPs (e.g., rubber). In other situations, harvesters continue to harvest the wild resource as no real motivation may exist to promote cultivation unless the product is highly marketable or scarce in the wild. Cultivation of tree NTFP species has been encouraged within agroforestry systems and these have assisted in providing an additional (often rather than an alternative) source of selected NTFPs. A frequently expressed concern with domestication is that it may play into the hands of the wealthy, i.e., those with land assets, or in the worst case scenario into the hands of the private sector, thus displacing poor local people from traditional income-generating activities (Wynberg 2004).

12.3 Research and Methodological Concerns

The research highlighted in Box 12.1 and reported in this book has provided valuable insights into the importance of NTFPs for human well-being, their harvesting and governance, the characteristics, uses and trade chains of particular species, and whether and how NTFPs can play a lead role in conservation and development. While the long-standing significance of NTFPs for rural people and their dependence on them has been confirmed, the initial euphoria around using NTFPs for poverty elimination and biodiversity conservation has been tempered. Not unsurprisingly a wide range of outcomes were documented, reflecting the disciplinary biases of researchers, the methods employed, the local and regional contexts in which livelihoods were operating, the agro-ecological potential of the site, the prevailing market structures, and the overarching policy and regulatory environment. This diversity of results and outcomes inevitably led to greater questioning of the worth of NTFPs, as well as the conditions in which they are used and managed. Conceptual divides between disciplines, conclusions based on inadequate or inaccurate data, and methodological drawbacks have further contributed to debates and confusion about NTFPs. This book has served to bring these debates and various perspectives together in a single volume.

Recently there has been increased inquiry regarding some of the methods used in NTFP research. Indeed, the diversity of methods employed is an area for concern, because these undermine the ability to draw comparisons between different studies (Gram 2001; Wong et al. 2001; Chauhan et al. 2008; Menton et al. 2010). To that end, the current cross-continental work under the Poverty and Environment Network (PEN) coordinated by CIFOR is useful (http://www.cifor.cgiar.org/pen/). However, it is also prudent to recognise that global studies are fraught with

methodological challenges given the difficulty of generating truly comparative data across species, continents, climates, cultures, and economies. Thus, broad-based conclusions based on international case studies need to be treated with caution, given the complexity and diversity of NTFPs, the seasonal nature of their use, and the specifics of the contexts in which they operate. For example, a key aspect of many NTFP valuation studies is quantifying subsistence value of NTFPs, however, this can often require multiple years of ecological and socioeconomic inquiry which the majority of research projects cannot afford (Chap. 3). The trend toward shorter-term field work, questionnaires as opposed to observation and snap shot, rapid appraisals disregarding seasonal and annual fluctuations of NTFPs has the potential to grossly misrepresent their use and value contribute little regarding their management or cultural significance. Accurate representation of NTFPs, particularly long-lived and culturally significant species, requires longitudinal data, yet funding and project cycles rarely provide for this.

Of further concern relating to methods is the number of studies that rely on a single approach, i.e., a once-off interview asking respondents to recall amounts harvested or consumed (in units alien to local users) during the last year. Such an approach commonly under-reports quantities harvested. For example, (1) children's use of forest goods, which is often substantial, is generally not captured at all; (2) recall of quantities for less frequently used resources is weak; (3) use of some resources can be highly variable from month to month or year to year, and therefore enquiring about "last year" can be imprecise; and (4) many surveys do not break down aggregate measures into a series of component questions, which are easier to comprehend and answer, and provide more reliable estimates. Furthermore, the perspective obtained may be biased according to the person interviewed and the interviewer (Fisher et al. 2010). These concerns require that most studies would benefit from a range of approaches over a period of time to elicit the required information at an acceptable level of quality.

This point is illustrated in a recent study by Menton et al. (2010) in which they undertook a comparative analysis of diary approaches for measuring quantities of forest products used versus recall methods recorded via a questionnaire. They found that 33% of product level estimates showed a threefold difference between methods. For products used in high quantities, survey methods tended to result in lower values than diaries and vice versa for less frequently used products. This suggests that many of the quantitative measures that exist for NTFP use could be underestimates since these are mainly based on surveys.

Furthermore, the significance of contextual setting requires further investigation, in particular agro-ecological potential and economic options available (Shackleton et al. 2007a). Much of the research on NTFPs is conducted in moist tropical systems, where the potential for agriculture production is significantly higher than in dry savannas or other semi-arid systems. Therefore, it may be feasible for investments in small-scale agriculture to have greater returns in reducing poverty in moist tropical systems. Similarly, in regions with high absorptive capacity for relatively unskilled labour in the formal or informal markets, NTFPs may not be the first choice for poverty alleviation. But, in countries or regions with low absorptive

capacities for unskilled labour, NTFPs may well have a comparative advantage. In countries or sites with both low agricultural potential and a surplus of unskilled labour NTFPs can be expected to be particularly important. As has been shown throughout the developing world, the poor rarely invest in a single livelihood strategy, and NTFPs are a common component within the suite of strategies employed. This very fact requires greater attention from government and development agencies, many of which remain unaware and uninformed, despite research generated over the last two decades.

12.4 NTFPs in a Changing World

The local and global contexts in which NTFPs are managed, harvested, used, or sold are constantly changing. Indeed, it is widely argued that we are presently experiencing a period of major global environmental and societal change, linked to increasing uncertainty regarding the future and greater fragility and instability in the complex social–ecological systems that form our world. A recent paper by Rockström et al. (2009) reviews the state of the Earth's nine life support systems and attempts to quantify their boundaries. Their research suggests that humanity has already transgressed the boundaries for three of these systems (climate change, rate of biodiversity loss, and changes in the global nitrogen cycle), and we are fast approaching the boundaries of others – the consequences of which are largely unknown. The Millennium Ecosystem Assessment (2005) indicated similar trends and highlighted the risk of pushing many of our systems beyond their thresholds. In terms of socioeconomic systems, the recent global economic recession is an illustration of how interconnected the world is and how a change in one region can result in unanticipated consequences for people and economies throughout the world (Meltzer 2009). Other changes such as improved communications technology may provide increased opportunities for forest product commercialisation and livelihood benefits from this.

These changes have implications for use of NTFPs and indicate the need for a dynamic view in terms of the systems as well as associated policies and interventions. Some of the broad-scale changes that are likely to impact distribution, access, and use of NTFPs are outlined below.

12.4.1 Land Transformation

The greatest impact on NTFPs is not overharvesting but land uses such as logging, agro-industries, and mining, which rapidly transform entire landscapes. Land transformation remains the primary driver of biodiversity loss internationally (Millennium Ecosystem Assessment 2005). Conversion of largely natural forests or

extensive rangelands to agricultural fields or plantations is the most widespread manifestation. Land transformation invariably results in diminished flows, or complete loss of benefits, from a wide range of NTFPs. Land transformation will generally have severe negative impacts on incomes of forest-reliant households, consumption patterns, and livelihood security. The relative trade-offs from the diminished supply, or loss of NTFPs, relative to the benefit streams from the transformed land, are crucial in the final analysis of livelihood gains or losses. But the conservation outcomes are invariably negative, with the possible exception of one or two species favoured by the transformation (e.g., cultivated NTFP species such as *Hoodia* in southern Africa).

The first exposé of the comparative economic potential of NTFPs was revealed (Peters et al. 1989) in evaluating the logging of high-value timber in moist tropical forests. But the pressure of commercial logging and transformation of tropical forests to plantations and agriculture continues unabated. Hence, the continued need to make visible the still hidden contribution of NTFPs to livelihoods and biodiversity conservation. Yet, the analyses in Chaps. 8 and 10 suggest that NTFPs have been insufficient to turn the tide of deforestation. In areas of Latin America and Asia, logging serves as a catalyst of broad land use change, frequently followed by agro-industries or fire. The synergistic effect of these land uses often suppresses regeneration of valuable NTFPs, leaving an impoverished landscape.

Given the consequences to livelihood security of land transformation for forest-reliant peoples, there is a dire need for longitudinal studies on NTFPs use and markets and elucidation of the drivers of change. In the meantime, governance structures, decision-makers, and planners need to appreciate that local land use options are not static, and so their policies and strategies for NTFPs and security of local livelihoods must be built around adaptive management and social learning.

12.4.2 Urbanisation

Early research on NTFPs tended to focus on remote forested locations, relatively intact environments, and forest-dependent people. During the past decade, additional attention has been paid by researchers to the use of NTFPs in urban and peri-urban environments and the active flux of products between forests and cities (Stoian 2005; Kilchling et al. 2009, Chap. 6, Fig. 12.5). The critical socioeconomic and cultural role of NTFPs in cities has expanded from the tropical to the temperate zone with rising demand for forest goods in both developed and developing countries. Furthermore, the increasing mobility of human populations globally has enhanced trade of forest goods as people's customs and traditions follow them (Padoch et al. 2008). Thus, rather than reducing demand, for many NTFPs it is simply a change in the locus of demand, and may even stimulate increased demand (Chaps. 4 and 6).

Fig. 12.5 Forest fruits and medicinal plants are purchased by all classes of society on street corners and in shops and open air markets in Belem, Brazil (photo: Trish Shanley)

12.4.3 Communication and Information Technology

The information and communication technology revolution is over two decades old and even remote countries and regions have felt its effects. Cellphone coverage in developing countries is increasing at a remarkable rate, as has e-mail and internet access. To the best of our knowledge, there is little analysis of the impacts of such new technologies on NTFP use and trade, but all the authors have first-hand experiences of the differences it has made in the lives of traders and rural communities in which we operate. The recent work of Overå (2006) provides some insights of how communication technology (most notably cellphones) has reduced transaction costs and increased profitably, networks and trust among small traders operating between remote regions and urban centers in Ghana. The most palpable effects of increased access to and use of communication technology relate to (1) increased access to information that underpin market negotiations and transactions (such as consumer preferences, international prices, design trends, transport availability and prices, etc.), (2) increased communication between suppliers and marketers which can potentially increase trust, and (3) potentially increased market demand as new markets are discovered further afield from the local or traditional ones.

Modern communication technology means that while the frequency of communication is increased, the costs of business are decreased as the transacting parties do not need to rely on face-to-face meetings, which are far more expensive in travel costs as well as the time for the personnel involved. Overå (2006) comments that the increased frequency of communication helps build trust between the transacting parties. This does not apply solely to producers and buyers. For example, woodcarvers in South Africa need a permit to fell carving timber. The process requires that they locate a suitable tree in the wild and then contact the relevant official, with whom they make an appointment to accompany them to measure the tree and calculate the required fee. In the past this used to take several visits to first locate

the official in the office (as he might be out with another woodcarver), which usually costs several days and repeated taxi fares to and from the office (Shackleton and Shackleton 2004). These arrangements are now done by cellphone, saving time and money (A. Shabangu pers comm. – former chairperson of the Mhala Woodcarvers Association). If costs are reduced, then goods are potentially cheaper and hence more competitive on international markets. Similarly in the state of Para, Brazil, radio programs have brought market intelligence to remote villagers, and cellphones assist traders to arrange with whom, how, and when their products will be transported to the market.

The benefits do not accrue solely from increased communication between producers and sellers, but also between networks at each end of the market chain. Thus, producers can communicate with other producers in different regions, to source surplus production, check prices, identify reliable buyers, share transport, plan joint harvesting trips, etc. Similarly, buyers can communicate more readily with networks of other buyers with whom they have a working association. Intermediaries can network both, such as Phytotrade Africa (http://www.phytotradeafrica.com), which is a business development and trade organisation, networking rural producers of forest products with markets and business partners in Europe. This need not apply only to cross-border trade but also to increasing regional trade with countries, especially large ones of the developing world, such as Brazil, South Africa, India, and China, where the costs of in-country travel are high due to the large distances.

12.4.4 Global Climate Change

The implications of global climate change for NTFPs and local communities are profound and will have a threefold impact. First will be increased livelihood vulnerability, especially of rural communities and small-scale farmers in drier ecosystems, and coastal fishing communities. As presented in Chap. 3, when already marginalised and remote communities are faced with hardships, many frequently turn to NTFPs as a fall back option. Thus, global climate change impacts are likely to increase the need for the traditional safety net function of NTFPs. This will only be possible if adequate habitats and stocks of NTFPs are maintained. Perversely, global climate change may, in some regions, accelerate rates of land transformation as farmers seek to cultivate larger areas to compensate for declining yields or more frequent losses of their entire yield through diseases, drought, or floods, which would reduce stocks or species available as a safety net.

The second repercussion of global climate change will be the increased vulnerability of some NTFP species as their environmental envelope changes. This may affect the distributions of NTFP species as well as the growth rates. There may also be synergistic negative impacts on species from the double stress of climate change and harvesting. Forest pest and disease outbreaks are also expected to increase as a result of changing rainfall patterns (IUFRO 2010), and this may further impact some NTFP species. Thus, for some regions and local communities, the supply of

NTFPs will diminish, or new indigenous and exotic species will come in as potential substitutes. These consequences will be particularly marked for species with cultural uses as cultural beliefs and practices are built up over time and adapt more slowly than direct subsistence requirements. Over the last few years there have been many niche models depicting expected changes in vegetation types and distributions of specific species (e.g., Wiens et al. 2010; Wiens and Bachelet 2010), but none have focused explicitly on NTFPs. This requires redress, albeit hampered by the limited biological knowledge pertaining to most NTFPs species. The effects of global climate change are also expected to favour some already aggressive invasive species (e.g., Bradley et al. 2010), which will add further threat to some NTFPs species; but the extent and degree currently remain unknown.

The third outcome of the global climate change is that arguments for conservation and reforestation of ecosystems will become more compelling (Hannah 2010). Current initiatives to reduce emissions from deforestation and degradation (REDD and REDD+) through sustainable forest management, for instance, could benefit the stocks of certain NTFPs. However, the manner in which such programs are implemented will be crucial for local livelihoods. If local communities are included and are partners in the management of and benefits from the conservation efforts, then it may become a win–win solution. But if, as is unfortunately often the case (Brockington and Igoe 2006), local communities are excluded, then promotion of forest conservation under REDD and other conservation projects is likely to have negligible or negative impacts on local livelihoods.

12.4.5 Globalisation and International Policies

At a national and international level, policies, aid, and trade agreements are important indirect drivers of change having both positive and negative impacts on ecosystem goods and services and their links to livelihoods. At an international level globalisation is a significant process having numerous impacts in many different spheres.

Regarding the effects of globalisation and international trade policies on NTFPs, limited information exists other than some evidence on the positive benefits of promotion and growth of global markets for NTFPs. But impacts may not always be obvious or positive and may involve trade-offs, especially for the poor. A report by UNEP-WCMC (2007) stressed how intensification of production and reliance on global markets may not always be of benefit to the poor. The changes associated with globalisation tend to "reduce the capacity of the local area to meet the needs of the local population, increasing dependency on the vagaries of markets" (UNEP-WCMC 2007). Global markets tend to seek the lowest priced supply, so that producers are vulnerable to being undercut and losing market share. Because of this, producers often try to maximise short-term gains, usually leading to accelerated rates of environmental degradation and eventually leaving local people in the position where they have neither the capacity to produce commodities for sale nor the local resource base on which to fall back.

In Mozambique, pressures on forests are growing due to Chinese interests in hardwoods (a trend also mentioned in tropical Africa) (Shackleton et al. 2010). Such commercial timber harvesting often occurs at the expense of the poor as they lose access to a host of important ecosystem services including NTFPs and receive few returns from timber sales. Moreover, the recent economic recession suggests the need for market diversification and to seek opportunities for NTFP commercialisation within local, national, regional, and global markets to spread risk (Shackleton et al. 2007a, b). Globalisation and global markets should not be seen as the silver bullet, certainly on their own. As is wise advice in an increasingly uncertain world, diversification is key – diversification of markets, NTFP products, and value chain pathways – as a route to building resilience to change.

There are many other global and local level changes affecting livelihoods, NTFPs, and the interface between the two. It is not possible to speculate on them all. The above provides ample illustration of the dynamic contexts in which livelihoods and NTFPs occur. Adaptation and change are integral aspects of sustainability, with use of NTFPs being a vital ingredient in facilitating adaptability. Consequently, researchers and policy makers need to develop a more nuanced view of NTFPs that takes into account their ever-changing contexts and if and how these contribute to vulnerability and/or resilience. Change and vulnerability can perhaps provide a new lens to consider the importance of NTFPs. It is expected that such ecosystem goods may become increasingly crucial in building resilience in social–ecological systems (IUFRO 2010).

12.5 The Next Chapter in the NTFP Story

12.5.1 Expected Trends

During the next decade, in both developed and developing countries, temperate and tropical regions, and urban and rural environments, use of NTFPs is anticipated to rise, with continuing trends observed during the past two decades. In developed nations, consumer preferences have shifted strongly toward organic and traditional products which have become firmly entrenched in middle class markets. Products exhibiting a rise in trade include scientifically confirmed herbal remedies, artisanal goods, naturally sourced cosmetics, and healthcare products. The sizeable growth of the middle class in Asian countries, such as India and China, would be expected to generate substantial new markets for NTFPs. Underlying motivations for increased use of forest goods among people include self-interest in health; concern with quality, fascination with the exotic; and a renewed interest in where, by whom, and how products are made.

In the future herbal remedies may not be a preferred option, but become the only affordable one. In times of economic hardship, rising unemployment, and reduction of state services, households turn to wild plants for food and healthcare out of need. This is presently witnessed in conflict areas throughout the globe as well as among

refugee populations (Pierce and Emery 2005). In African countries afflicted with high rates of HIV, for example, households increasingly rely on traditional medicines and foods as part of their coping strategies (Kengni et al. 2004). As forests become degraded and conflict over natural resources becomes more acute, the knowledge base of elders and written documentation of traditional healing and management practices may resume significance. The impacts of climate change on conventional agricultural systems are also expected to increase use and reliance on wild resources (see Sect. 12.4.4). For example, a study of responses to climate induced risk in Mozambique revealed increased consumption of wild foods (as an asset conservation strategy) and the sale of wild products in nearby urban centers as two key coping mechanisms (Osbahr et al. 2008).

Where and when will use of NTFPs be expected to decrease? Trade in niche, high end, luxury products may decline due to the lack of a sufficiently strong consumer base coupled with global economic downturn. Furthermore, use and/or sales of specific NTFPs which are wholly overharvested and where efforts toward domestication are embryonic or nonexistent will also drop. Trade in vulnerable, slow-growing species, which occur in low densities with low reproductive capacity, will decline as the species become rarer and/or extinct. Examples include the trade to China of wildlife parts from endangered African mammals, wild sourced swift nests from Kalimantan, and select "conflict of use" NTFPs in Latin America.

Thus, the future scenario is both optimistic and pessimistic in terms of the ability of NTFPs to continue to deliver livelihood benefits to local people and ensure biodiversity and forest conservation. However, due to the importance of NTFPs to the livelihoods of millions of poor rural and urban people, research and practical and policy support will be needed. Some suggestions for areas requiring greater attention are outlined below.

12.5.2 Moving Forward: Facilitation, Capacity Building, and Increasing the Representation of Marginalised Groups

In considering how to improve the use, sustainable management, and trade of NTFPs, it is important to recall that for centuries, people throughout the world have capably devised ways to extract, process, transport, and trade NTFPs without any intervention at all. Often, what is needed is not intervention, but simply allowing collectors' access to resources and markets (Laird et al. 2010). Policies which do not inhibit the use of land and/or resources and which do not favour large agro-industries over small holders are some of the most fundamental and crucial factors in supporting NTFP use. However, given the tendency of NGOs, research institutions, and governments to favour and implement "interventionist" and/or "project" approaches to both conservation and development, it is useful to understand if, what, and how interventions assist in helping to realise the full potential of NTFPs.

Professionals in the fields of development and research routinely offer policy recommendations based on the assumption that "intervention" is necessary and will lead to a "trickle down" of benefits for households classified as poor. However, in

some cases, supporting locally crafted practices of NTFP collectors and customary resource management arrangements can be more appropriate than outside intervention. In addition, as case studies within Chap. 11 of this book attest, caution is advised with any policy change or intervention which will impact the lives of marginalised, often "invisible" populations.

Governmental and NGO capacity to effectively work with NTFPs and harvesters is nascent and needs to be built among foresters, policy makers, NGOs, and researchers. Cross-sectoral collaboration among governmental agencies involved in fields such as forestry, health, culture, agricultural, and education is also essential for successful facilitation of NTFP use, management, and trade. Investments in NTFPs as a vehicle for poverty alleviation and development can be included in the basket of options considered by central and regional governments alongside other strategies such as subsidies, public works programs, local economic development initiatives, and investments in agricultural infrastructure. NTFPs, like other, often part-time, livelihood options in which the rural poor engage, i.e., small-scale agriculture, livestock, petty trading, unskilled labour, or low-level employment, deserve concomitant government attention and resources.

Although not the domain of most governmental officials or researchers, one major area of weakness for NTFP collectors is lack of representation. Given their weak political position throughout the globe, attention and action is needed to organise disparate collectors. Select grass roots movements have proven successful in organising forest-reliant people for the purpose of exchanging information, improving sustainable management practices and trade, and working toward improved representation at the national level (see Box 12.2). In southern Africa, PhytoTrade (Southern African Natural Products Trade Association) has developed sustainable and ethical supply chains for wild harvested food, cosmetic, and medicinal plants, involving 20,000 collectors from eight countries (Nemarundwe et al. 2009). Resin tappers in Cambodia are expanding from small village associations into a federation which is providing practical information on trade and product development as well as pressing for policy change to protect forests in which resin tapping trees occur. In Brazil, the National Council of Rubber Tappers has successfully lobbied for the creation of extractive reserves, thus securing over 52 reserves and land rights for tens of thousands of forest-reliant people.

Box 12.2 Development from the Ground Up: Forest Honey in Asia

Jenne de Beer, International Association of Ethnobiology, Darrell Posey Fellow, and South and South East Asian NTFP Exchange Program, Manila, Philippines, ntfp7@yahoo.co.uk

What types of facilitation do collectors of NTFPs need to harvest resources sustainably, process products efficiently, and market profitably? The South and Southeast Asian NTFP Exchange Programme (NTFP-EP) has been working for over a decade in seven countries in support of local communities

(continued)

that depend on non-timber forest resources for their livelihoods.[1] This network of People's Organisations and NGOs is driven by local demand and aims at offering bottom-up support and exchange between NTFP collectors on how to initiate and sustain successful livelihood ventures. The effort focuses on a broad range of NTFPs, including wild fruits, tree resins, materials for craft making, and forest honey.

The case of honey is useful to demonstrate key, generic lessons learned. Wild gathered forest honey, primarily produced by the bee species, *Apis dorsata*, has long been a sought after delicacy in much of Asia. However, consumers have been concerned with quality issues such as adulteration, and the resource base has been under threat due to forest degradation. In order to address the situation, starting in the late 1990s, several pilots with forest honey collector groups were initiated within the NTFP-EP network. Recently, these pilots have grown into full maturity and expanded well beyond the original sites. The introduction of sustainable harvesting practices and improved hygienic handling techniques has led to the achievement of high-quality standards region-wide. Furthermore, network partners have begun taking pride in guaranteeing the purity of the product. Strict internal rules have been established, while traceability of the source of origin has been made relatively easy.

Results from these initiatives are impressive, and local media have helped to spread the word to consumers. Markets have opened and income derived from honey and wax collection has, in many cases, increased significantly.[2] Finally, organised honey collectors play an increasingly active role in forest conservation.[3]

Select lessons learned[4] from building capacity among honey collectors include:

- *Aim for a holistic approach*. From the start, simultaneously address livelihood, conservation, and sustainable management, as well as issues regarding land tenure

(continued)

[1]The Philippines, Indonesia, Malaysia, Cambodia, Vietnam, India, and Bangladesh.

[2]For an example see Pavel Partha and Rumaisa Samad "In Solidarity with Sunderban Honey Wisdom" in: Voices from the Forest 18, April 2010.

[3]See for an example: JMHI, Dian Niaga, NTFP-EP 'Forest Honey and Forest Conservation: What is the Link? Report of the national forest honey workshop', Jakarta, October 2008.

[4]For more detailed observations and guidelines, particular in relation to community enterprise development see: Jenne de Beer and Ma. Christina S Guerrero "Lessons learned from Experience" in Yasmin Arquiza (ed.) From Seeds to Beads; Tales, Tips and Tools for Building a community-based Enterprise. NTFP-EP, Quezon City, 2008.

- *Avoid quick fixes*. Instead, assure long-term commitment over extended periods
- Ensure that the communities' aspirations and concerns are fully taken into consideration. The work should begin as and remain the community's own initiative
- Eventual self-reliance of the grass root partners involved requires finding simple and culturally appropriate solutions

Finally, avoid becoming a gate keeper. Empower community organisations by providing them with direct links to top notch expertise, trade contacts, and policy makers.

In the Brazilian case, where forest-reliant communities have successfully organised on issues related to NTFPs, the participation of women was critical to success. Although women have demonstrated a vital role in the use in and trade of NTFPs worldwide, they generally possess relatively scant political power and often have negligible opportunities for entry into decision-making roles. Given their crucial household responsibility in the use and trade of NTFPs, and their tendency to perceive forests as related to the health and welfare of their families, organisation of NTFP harvesters will likely be more successful with increased women's participation. Notably, the organisation, education, and lobbying efforts needed to facilitate the use and trade of NTFPs require a combination of elements which are difficult to encounter singly much less together: sustained commitment on the part of collectors and facilitators; flexibility of NGOs to listen to local needs; collaboration and transparency among governmental sectors, long-term time frames; and a low level of steady financial support.

12.5.3 Future Research and Policy Needs and Challenges

On the positive side, statistics indicate that there have been a rising number of publications on NTFPs over the last two decades indicating increased interest in NTFPs on the part of researchers. However, it is less common to find examples where research has helped lead to a change in policies and/or practices that assist NTFP collectors. In spite of scattered exceptions, NTFP collectors remain poorly represented, their products continue to be absent from national statistics, and collectors receive few state services. Not only invisible to policy makers, forest product collectors may have also become less visible to and/or consulted by researchers, who have a growing tendency to "design their studies from behind a computer". NTFP studies that are insufficiently grounded in real life needs and scenarios can lead to less irrelevant, financially wasteful, and inappropriate investigations (J. de Beer personal communication).

Furthermore, donors frequently reinforce the latest funding trends rather than more essential investigations. Over the last two decades there has been ongoing interest in market-based conservation efforts, principally focused on international markets (Laird et al. 2010). However, these are often inappropriate, of high risk, and and/or impossible for remote forest collectors to attain (i.e., carbon). The greatest and most consistent value for local communities is usually found in subsistence use and local trade in NTFPs, yet far fewer funders, researchers, or policy makers have given sustained attention to local use and trade and/or in securing access to and protecting the safety net functions of forests (e.g., Shackleton et al. 2007a, b). Nor do donors and researchers generally commit or invest in the long-term time frames necessary to build the trust of forest-reliant people and to understand the ever-changing landscape dynamics necessary to gain even a partial understanding of these vital issues.

An additional bias in the fields of conservation and development toward intervention frequently drives the establishment of new laws or actions before a solid understanding of the problems and issues they are meant to address is built (Laird et al. 2010). In addition, substantial attention has been given by researchers, funders, and policy makers to sustainable extraction of NTFPs. However, forest degradation and destruction resulting from commercial agriculture, logging, and mining frequently cause far more damage to NTFP populations than overharvesting. Given limited resources, primary focus is needed on threatened species and those that are intensively traded (Laird et al. 2010).

Positive exceptions at the local and national levels exist and effective initiatives need attention so that lessons can be learned. For example, the Finnish government collects detailed annual statistics on trade in berries and other NTFPs, making visible the significant economic and socio-cultural value of NTFP collection (Richards and Saastamoinen 2010). In the Philippines the national government is recognising ancestral domain and the significant local capacity to manage forest resources based on customary laws which often provide a more nuanced approach to regulation (Novellino 2010). In eastern Amazonia, the state of Para has recently decreed that forest product collectors will be entitled to the same rights, such as retirement benefits, as agricultural workers.

In addition to legislation, actions which celebrate the cultures and traditions linked to forest products can fortify efforts to protect species and landscapes. In India, China, and the UK, formal healthcare systems recognise and value herbal healing traditions. Revitalisation of forest-based customs and pride in traditional crafts and foodstuffs has grown within communities (Fig. 12.6) as well as been instilled through rising international and regional demand for native crafts and natural foods and medicines. Government support of craft traditions throughout Latin America, Africa, and Asia is assisting in elevating the status of both forest goods and collectors. As researchers and governments grapple with issues such as environmental degradation, adaptation to climate change, declining state services, and increased incidence of infectious diseases, cursory attention has been drawn to NTFPs as one potential means to mitigate environmental harm and socioeconomic ills. NTFPs currently serve crucial safety net functions and contribute to the livelihoods of billions of people on earth. In an

Fig. 12.6 Women benefit from being able to manufacture NTFP goods at home. Grass (*Festuca costata*) broom makers, Bushbuckridge, South Africa (photo: Sheona Shackleton)

uncertain future, their role is likely to expand; thus governmental agencies, researchers, NGOs, and donors may be well served by devoting more serious and sustained attention to forest goods, services, and peoples.

12.6 Concluding Remarks and Key Emerging Messages

This book is a first in providing an analytical global overview of the many aspects that need consideration when researching and promoting the use and management of NTFPs. Beginning with a discussion around what is meant by an NTFP, we moved on to considering the importance of these products for poor people; their role in livelihoods; the cultural benefits they bring; the factors affecting their management, use, and governance; their marketing and economic importance as globally traded products; and where they are situated in a changing world context. We explored the evolution of sentiments regarding the potential of NTFPs in promoting options for sustainable multi-purpose forest management, income generation, poverty alleviation, and biodiversity conservation. Based on critical analysis of debates and discourses, we employed a systems approach to providing an integrated, balanced, and realistic perspective on the benefits and challenges associated with NTFPs and their use. At the same time, we were outspoken in our analysis where we believed this necessary, drawing on our own extensive experiences on the ground. While absorbing all of this information, a number of diverse issues began to emerge that we judge to be important, but somewhat neglected;

these key "take home" messages are summarised in Box 12.3. We hope that they will stimulate the reader to look at NTFPs from a deeper, more integrated and renewed perspective.

Box 12.3 Key Emerging Messages

Patricia Shanley and *Sheona Shackleton*, Center for International Forestry Research and Woods and Wayside International, Princeton, NJ 08540, USA and Department of Environmental Science, Rhodes University, Grahamstown, South Africa, p.shanley@cgiar.org; s.shackleton@ru.ac.za

Theme	Message
Thinking broadly and locally about NTFPs	
Multiple values	NTFPs have multiple values and contribute a range of livelihood assets or capitals. More attention needs to be given to their vast importance in subsistence use and local trade. The role of NTFPs is best understood not solely in narrow economic terms or on internationally traded goods. The focus on internationally traded commodities has skewed research efforts, conclusions, funding, and policy.
Culture matters	Given that they are not quantifiable, cultural values which, to varying degrees, are of critical importance in the daily lives, and Culture Matters customs of people worldwide have generally been ignored with negative repercussions for funding, research direction, and policy. The cultural connections of people to specific species and their landscapes can be a powerful motivator for conservation.
Recognise local efforts	Terms such as "multiple use" and "agroforestry" describe practices that are regularly employed by rural people throughout the world. It is important to recognise and build on land management systems that are already undertaken by local people, rather than to reinvent it as an academic exercise.
Women are critical	In many cultures, women's task of treating the health needs of the family drives them to see and utilise the landscape in terms of its nutritional and medicinal benefits. Capitalising on these sensibilities can give momentum to conservation movements and/or sustainable management practices.
NTFPs are part of a diverse livelihood portfolio	NTFPs usually form one activity that rural households undertake to sustain their livelihoods. There is a need to situate NTFP use within the broader livelihood portfolio and income sources to fully understand their role and importance.
Seeing the bigger picture	Despite decades of research, a recurrent blind spot regarding NTFPs is an understanding of the socioeconomic impact that declining access and reduced abundance of NTFPs has on markets and households. As NTFPs become less accessible, families that independently met some of their basic health, nutritional, and income needs through use of forest goods no longer can. A deeper understanding of the true value of forests is necessary to prevent further degradation of social and ecological systems and the subsequent ample costs to governmental agencies

(*continued*)

Theme	Message
Getting NTFPS on the agenda: policy and practice issues	
Make NTFPs more visible: record the statistics	Most countries are unable to provide FAO with reliable statistics regarding the national and international volume of trade in NTFPs. Modifications to censuses and to natural resource transportation accounting practices could assist in filling this enormous gap in knowledge. Incentives to quantify NTFP values would help to improve the visibility and understanding of these critical but still hidden products.
Enhance forestry extension and education	Forestry extension/education is often insufficient for timber and frequently nonexistent for NTFPs. Forestry training is needed which integrates management of timber and NTFPs and which takes into account both economic and livelihood concerns.
Cross-sectoral collaboration	Cross-sectoral collaborations are needed for effective work on NTFPs. Ministries of agriculture, education, health, culture, technology, etc. can each play a significant role in the use and management of forest resources. Health care, in particular, can be an important catalyst for sustainable practices through fostering an understanding of landscape health as a reflection of human health.
Green marketing	Additional attention and consumer education is warranted on issues of sustainability of trade in NTFPs. Efforts in research, education, and policy are needed to ensure that vulnerable tree species or species with high livelihood importance are not extracted and marketed as certified and/or "green" timber.
Identifying research problems and gaps	
Conceptual bias	The literature regarding NTFPs reflects a conceptual divide between researchers who spend time in rural communities with local people (anthropologists, botanists, and ecologists) and those from a policy or economics perspective who generally have less direct contact with the environment or people they study. This disciplinary divide can influence discourse regarding the value of NTFPs.
Conflict of use	Large-scale logging, ranching, and agriculture are expanding in many regions yet insufficient attention is being paid to the impact of these industries on species composition and livelihoods. Placing blame on collectors for overexploitation and research emphasis on sustainable off-take has taken attention away from large-scale regional deforestation issues.
Which NTFPs?	Research is needed on species which are vulnerable to trade (such as long-lived primary forest species) and also on those species which can live in harsh, pioneer environments. Universities, research organisations, communities, and local cooperatives can help to fill in knowledge gaps by proactively identifying widely used and traded species, pooling their knowledge bases and filling gaps. Widely marketed barks, roots. and latexes can represent particularly vulnerable parts of plants and need particular attention.

References

Bradley BA, Wilcove DS, Oppenheimer M (2010) Climate change increases risk of plant invasion in the Eastern United States. Biol Inv 12:1855–1872

Brockington D, Igoe J (2006) Eviction for conservation: a global overview. Conserv Soc 4:424–470

Chauhan KV, Sharma AK, Kumar R (2008) Non-timber forest products subsistence and commercial uses: trends and future demands. Int Forest Rev 10:201–216

Edwards PJ, Abivardi C (1998) The value of biodiversity: where ecology and economy blend. Biol Conserv 83:239–246

Fisher M, Reimer JJ, Carr ER (2010) Who should be interviewed in surveys of household income? World Dev 38:966–973

Gram S (2001) Economic valuation of special forest products: an assessment of methodological shortcomings. Ecol Econ 36:109–117

Hannah L (2010) A global conservation system for climate change adaptation. Conserv Biol 24:70–77

IUFRO (International Union of Forest Research Organisations) (2010) Making African forests fit for climate change. A regional view of climate change impacts on forests and people and options for adaptation. Policy brief. IUFRO, Austria

Kengni E, Mbofung CMF, Tchouanguep MF, Tchoundjeu Z (2004) The nutritional role of indigenous foods in mitigating the HIV/AIDS crisis in West and Central Africa. Int Forest Rev 6:149–160

Kilchling P, Hansmann R, Seeland K (2009) Demand for non-timber forest products: Surveys of urban consumers and sellers in Switzerland. For Policy Econ 11:294–300

Laird SA, McLain RJ, Wynberg RP (2010) Wild Product Governance: finding policies that work for non-timber forest products. Earthscan, London

Laurance WF (2007) Have we overstated the tropical biodiversity crisis? Trends Ecol Evol 22:65–70

Leakey RRB, Tchoundjeu A, Smith RI, Munro RC, Foundoun JM, Kengue J, Anegbeh PO, Atangana AR, Waruhiu AN, Asaah E, Usoro C, Ukafor V (2004) Evidence that subsistence farmers have domesticated indigenous fruits (*Dacryodes edulis* and *Irvingia gabonensis*) in Cameroon and Nigeria. Agrofor Syst 60:101–111

Meltzer AH (2009) Reflections on the financial crisis. Cato J 49(1):25–30

Menton MC, Lawrence A, Merry F, Brown ND (2010) Estimating natural resource harvests: conjectures? Ecol Econ 69:1330–1335

Michon G (2005) Domesticating Forests: how farmers manage forest resources. CIFOR, ICRAF, Bogor Indonesia. Millennium Ecosystem Assessment (2005) *Ecosystems and human well-being: synthesis*. Island, Washington, DC

Nemarundwe N, Le Breton G, Chibaya I (2009) Linking rural producers of natural products to global markets for poverty alleviation in Southern Africa. XIII World Forestry Congress Buenos Aires, Argentina, 18–23 October

Novellino D (2010) From indigenous customary practices to policy interventions: the ecological and sociocultural underpinnings of the non-timber forest trade on Palawan Island, the Philippines. In: Laird SA, McLain RJ, Wynberg RP (eds). Wild Governance – Finding Policies that Work for Non-timber Forest Products, Earthscan, London, 83–198

Osbahr H, Twyman C, Adger N, Thomas D (2008) Effective livelihood adaptation to climate change disturbance: scale dimensions of practice in Mozambique. Geoforum 39:1951–1964

Overå R (2006) Networks, distance, and trust: telecommunications development and changing trade practices in Ghana. World Dev 34:1301–1315

Padoch CE, Brondizio S, Costa M, Pinedo-Vasquez R, Sears R, Siqueira A (2008) Urban forest and rural cities: multi-sited households, consumption patterns, and forest resources in Amazonia. Ecol Soc 13(2):2, [online] URL: http://www.ecologyandsociety.org/vol13/iss2/art2/

Pierce AR (2002) American ginseng (*Panax quinquefolius*). In Shanley P, Pierce A & Laird S (eds) Tapping the green market: certification and management of non-timber forest products. Earthscan, London, pp 172–182

Pierce AR, Emery MR (2005) The use if forests in times of crisis: ecological literacy as a safety net. For Trees Liveli 15:249–252

Peters CM, Gentry A, Mendelsohn RO (1989) Valuation of an Amazonian rainforest. Nature 339:655–656

Plotkin M, Famolare L (eds) (1992) Sustainable harvest and marketing of rain forest products. Conservation International. Island, Washington, DC

Richards RT, Saastamoinen O (2010) NTFP policy, access to markets and labour issues in Finland: impacts of regionalisation and globalisation on the wild berry industry. In Laird SA, McLain RJ, Wynberg RP (eds) Wild Governance – Finding Policies that Work for Non-timber Forest Products, Earthscan, London, 287–308

Rights and Resources Initiative (RRI) and International Tropical Timber Organisation (ITTO) (2009) Tropical forest tenure assessment: Trends, challenges and opportunities. RRI and ITTO, Washington, DC

Rockstöm J, Steffen W, Noone K, Person Å, Chapin FS, Lambin E, Lenton TM, Scheffer M, Folke C, Schellnhuber HJ, Nykvist B, de Wit CA, Hughes T, van der Leeuw S, Rodhe H, Sörlin S, Snyder PK, Constanza R, Svedin U, Falkenmark M, Karlberg L, Corell R, Fabry V, Hansen J, Walker B, Liverman D, Richardson K, Crutzen P, Foley J (2009) Planetary boundaries: Exploring the safe operating space for humanity. Ecol Soc 14(2):32, [online] URL: http://www.ecologyandsociety.org/vol14/iss2/art32/

Shaankar RU, Ganeshaiah KN, Krishnan S, Ramya R, Meera C, Aravind NA, Kumar A, Rao D, Vanaraj G, Ramachandra J, Gauthier R, Ghazoul J, Poole N, Chinnappa Reddy BV (2004) Livelihood gains and ecological costs of non-timber forest product dependence: assessing the roles of dependence, ecological knowledge and market structure in three contrasting human and ecological settings in south India. Env Conserv 31(3):242–253

Shackleton CM, Shackleton SE, Gambiza J, Nel E, Rowntree K, Urquhart P, Fabricius C, Ainslie A (2010) Linking ecosystem services and poverty alleviation in the arid and semi-arid lands of southern Africa. Nova Publishers, New York

Shackleton CM, Shackleton SE, Buiten E, Bird N (2007a) The importance of dry forests and woodlands in rural livelihoods and poverty alleviation in South Africa. For Policy Econ 9:558–577

Shackleton SE, Shackleton CM (2004) The *Pterocarpus angolensis* DC. based woodcraft industry in the Bushbuckridge district, South Africa. In: Sunderland T, Ndoye O (eds) Forest products, livelihoods and conservation: case studies of Non-timber forest product systems Vol 2 – Africa. CIFOR, Bogor, pp 203–228

Shackleton SE, Shanley P, Ndoye O (2007b) Viable but invisible: Recognising local markets for non-timber forest products. Int Forest Rev 9(3):697–712

Stoian D (2005) Making the best of two worlds: rural and peri-urban livelihood options sustained by non-timber forest products from the Bolivian Amazon. World Dev 33:1473–1490

UNEP-WCMC (2007) Biodiversity and poverty reduction: The importance of biodiversity for ecosystem services. United Nations Environmental Programme World Conservation Monitoring Centre (UNEP-WCMC), Cambridge

Wiens JA, Bachelet D (2010) Matching the multiple scales of conservation with the multiple scales of climate change. Conserv Biol 24:51–62

Wiens JA, Stralberg D, Jongsomjit D, Howell CA, Snyder MA (2010) Niches, models, and climate change: Assessing the assumptions and uncertainties. Proc Natl Acad Sci 106:19729–19736

Wong JLG, Thornber K, Baker N (2001) Resource assessment of non-wood forest products: experience and biometric principles. Non-wood Forest Products 13, FAO, Rome, 109 pp

WRI (2005) The wealth of the poor: managing ecosystem to fight poverty. WRI, Washington, DC, p 255

Wynberg R (2004) Achieving a fair and sustainable trade in devil's claw (*Harpagopytum* sp.). In: Sunderland T, Ndoye O (eds) Forest products, livelihoods and conservation. Case studies of non-timber forest product systems. Volume 2: Africa. Centre for International Forestry Research (CIFOR), Bogor